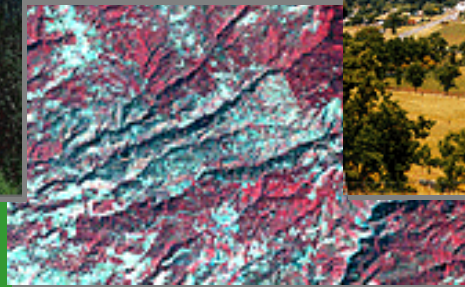




# FRAP Assessment: Inventory and Monitoring for Climate Change Analysis

California Department of Forestry

Mark Rosenberg



Acknowledgements

Ralph Warbington, Retired USFS

Carlos Ramirez, RSL

Lisa Fischer, FHP

**Visit our web site at: <http://frap.cdf.ca.gov> or  
<http://www.fs.fed.us/r5/rsl/projects/mapping/zone-map.shtml>**

# FRAP MANDATE

## PRC 4789

- Mandates an Assessment of Forest Resources to guide forest policies for the State.
  - An assessment and analysis of the supply and availability of forest and rangeland resources of the state
  - A discussion of important policy considerations, laws, regulations, management responsibilities, and other factors expected to influence and significantly affect the use, ownership, and management of forest and rangeland resources.
- Systematic overview of the status and trends on CA forests
- Forest condition and extent
- Trend analysis and reporting

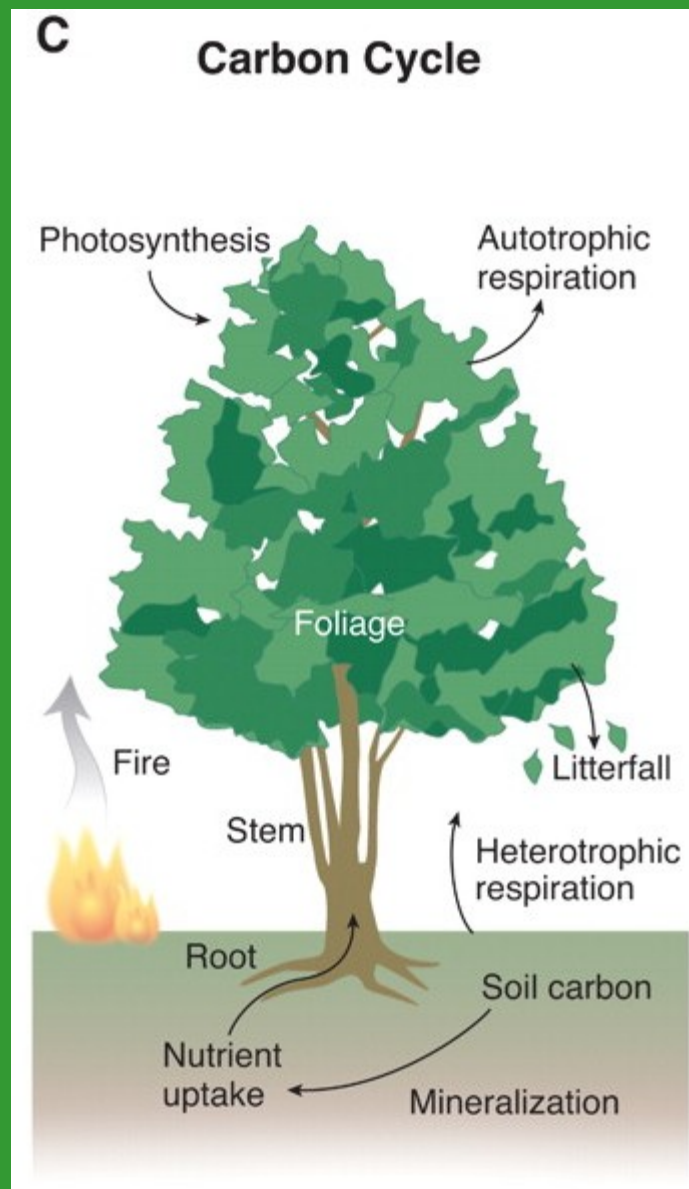
# FRAP Assessment Climate Change Chapter

## June, 2010

Provides a review of potential climate change impacts on forest and range lands in California.

### Assessment Activities

- Model Changes in carbon stock for 2010, 2020, 2050 and 2100 (fire and insect/disease threats) (MC1 model)
- Model potential changes in vegetation distribution (BIOMOVE – UCSB collaboration)
- Establish Indicators for Climate Change based on temperature, precipitation, snow water equivalents.



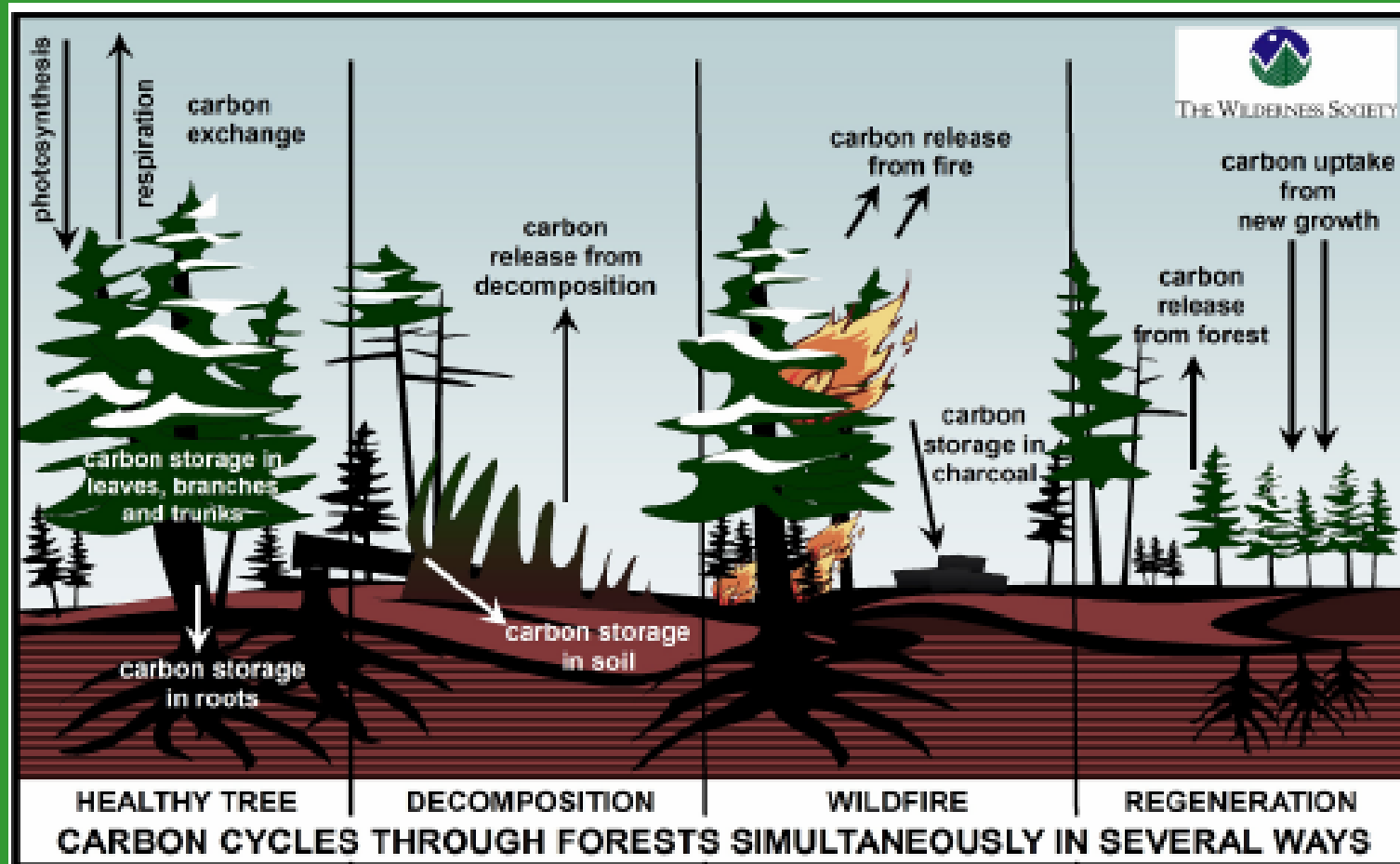
## Forest Carbon Pools

- Bole
- Branch and Leaf Foliage
- Roots
- Down Woody Debris
- Soil Organics\*

G. B. Bonan *Science* 320, 1444 -1449 (2008)

Published by AAAS

# Carbon Pools in Forests



Source: The Wilderness Society



# Land Cover Mapping and Monitoring Strategy

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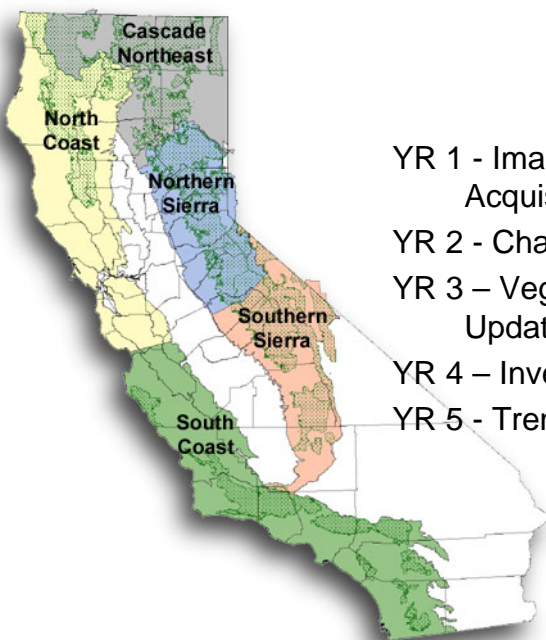
CA Land Cover Mapping and Monitoring Program (LCMMP) provides data and analysis via WWW

- Cooperative Among CAL FIRE and USFS
- Data for Forest and Rangelands
- Vegetation Mapping Component
- Vegetation Monitoring Component
- Coordinated Schedule



# Cooperative Strategy

## 5 Panel Project Areas



- YR 1 - Imagery Acquisition
- YR 2 - Change Detection
- YR 3 - Vegetation Updates
- YR 4 - Inventory
- YR 5 - Trend Analysis

## Vegetation and Fuels Mapping

### Statewide 5- 10 year Cycle

- Baseline Vegetation Map
- Inventory Link
- Change Monitoring
- Vegetation Map updates
- Trend analysis

# Cooperative Mapping Approach

- Make use of existing vegetation data
  - Cost effective
  - Avoids redundancy
  - Promotes ownership and acceptance of data and analysis
  - Encourages collaboration
- Define a consistent spatial base (polygons)
  - Independent of map attributes
  - Stand based
  - Objective delineation of landscape features
- Hierarchically add thematic detail necessary to meet map standards
  - Specific focus on detailed type and structure attributes
- Accuracy assessment
  - Forest inventories used for independent accuracy assessment and as a statistical sample for forest attributes



# Vegetation Product Description

## Vegetation Type in 2 classification schemes

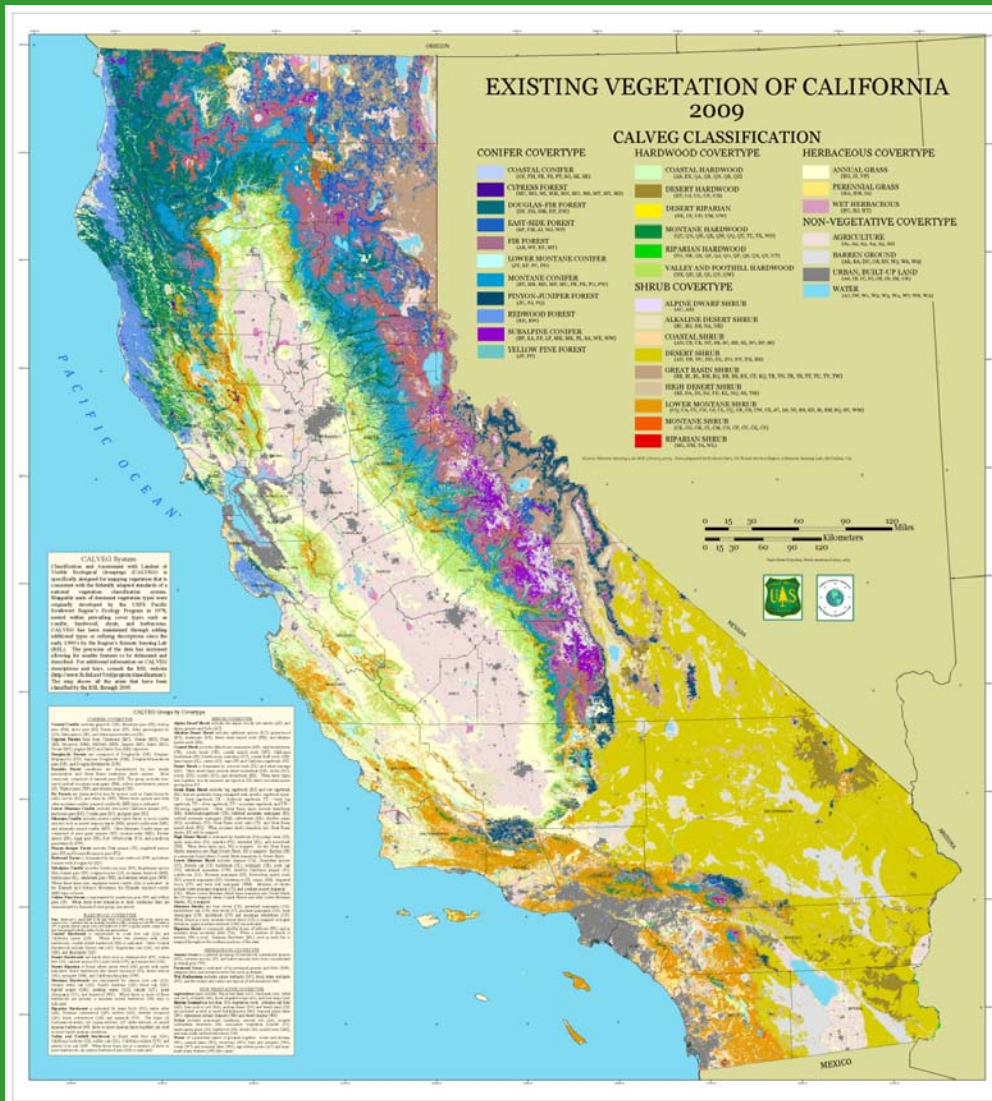
- CALVEG (FGDC Alliance Level)
- Wildlife Habitat Relationships

## Crown Closure in 10% class breaks

## Size (seedling, sapling, pole, small, medium, large, Multi-storied)

## Primary and Secondary Attributes in Tree types

[http://www.fs.fed.us/r5/rsi/projects/rdb/layers/ev\\_mid.html](http://www.fs.fed.us/r5/rsi/projects/rdb/layers/ev_mid.html)




# Land Cover Monitoring

## Methods

Time 1 Image



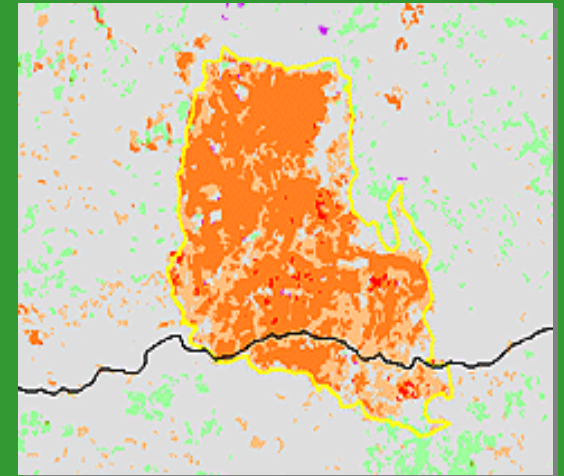
 Red is a presence of vegetation




Time 2 Image



 Gray is an absence of vegetation

Change Detection Map



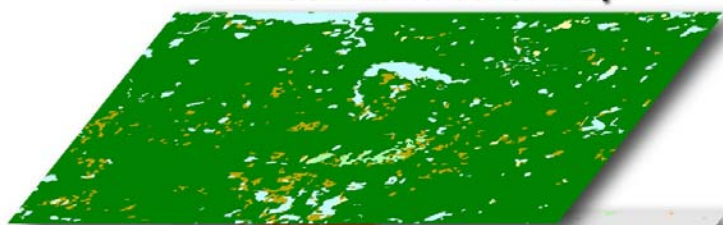
 Decrease in vegetation cover  
 Increase in vegetation cover  
 No change in vegetation cover

- **LANDSAT, Aerial photos, field data, other imagery sources used to classify change**

# LCMMP Coming Together

## Land Cover Map Update Process

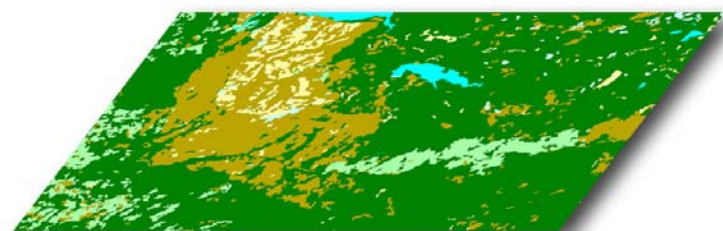
1991 Land cover map



Land cover changes between 1991 and 1996



Remap



1996 Land cover map (updated)

- Establish Baseline Vegetation Information
- Re-map only where changes are identified
- Vegetation data updated



# Land Cover Monitoring

Identifying Causes of Change is facilitated by tracking activities such as wildfire, harvesting, and insect and disease outbreaks using GIS

- Wildfire
- Rx burn
- Mortality
- Harvesting
- Thinning
- Regeneration
- Development
- Conversion
- etc.

Compile data from multiple agencies





# Land Cover Monitoring

## Identifying Causes of Change Using GIS: North Sierra 2000-2005

2005 Air Photo



Fire Perimeters



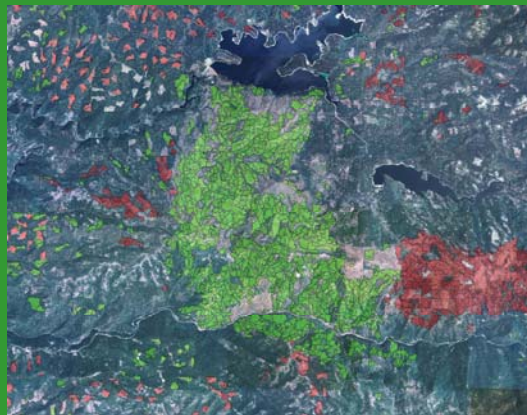
THP 1996-1999



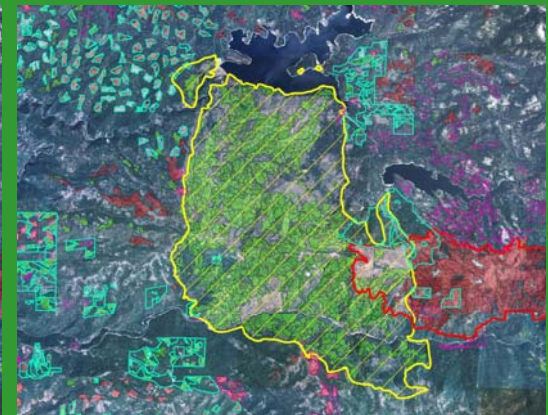
THP 2000 - 2005



Change Data 2000-2005



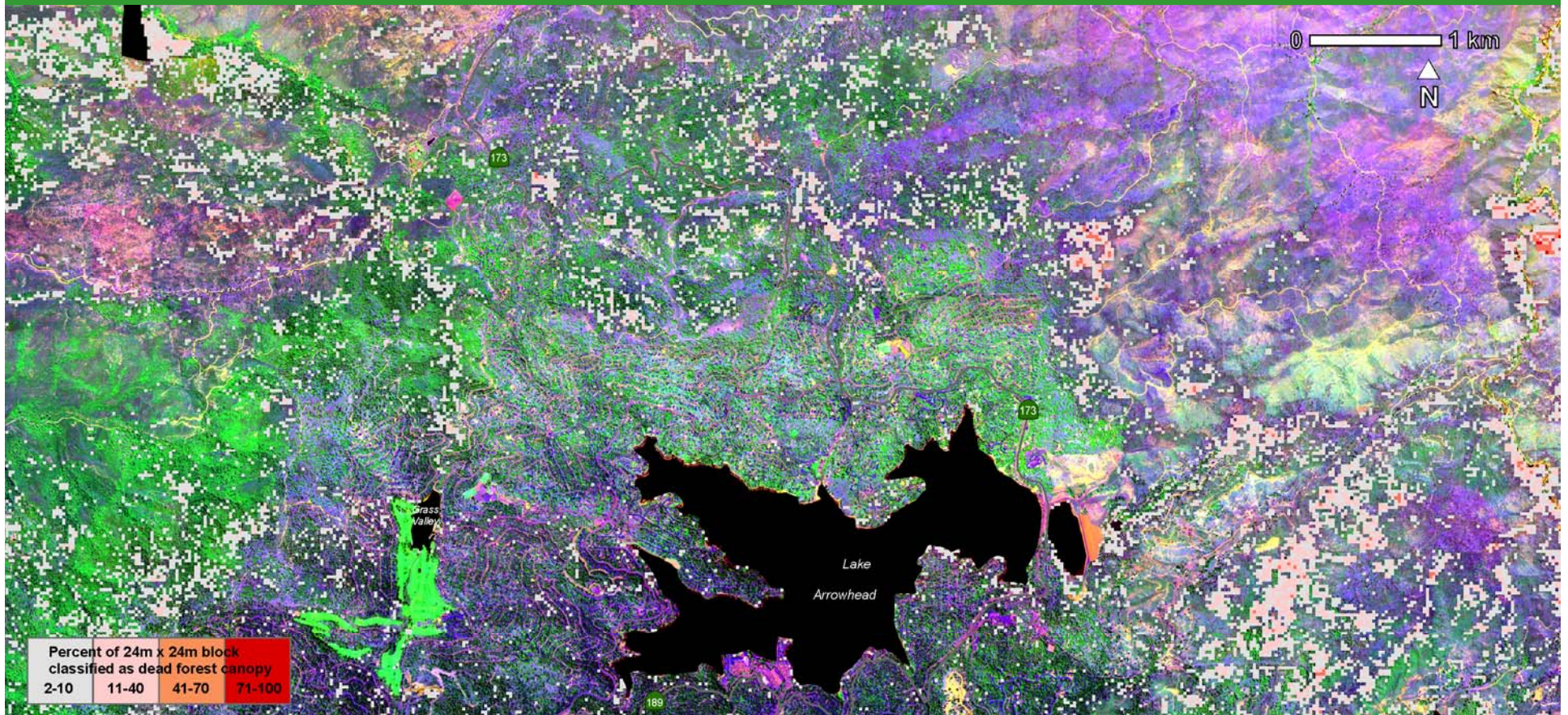
Cause of Change





# Trends in Forest Mortality:

## 2007 Southern California Tree Mortality

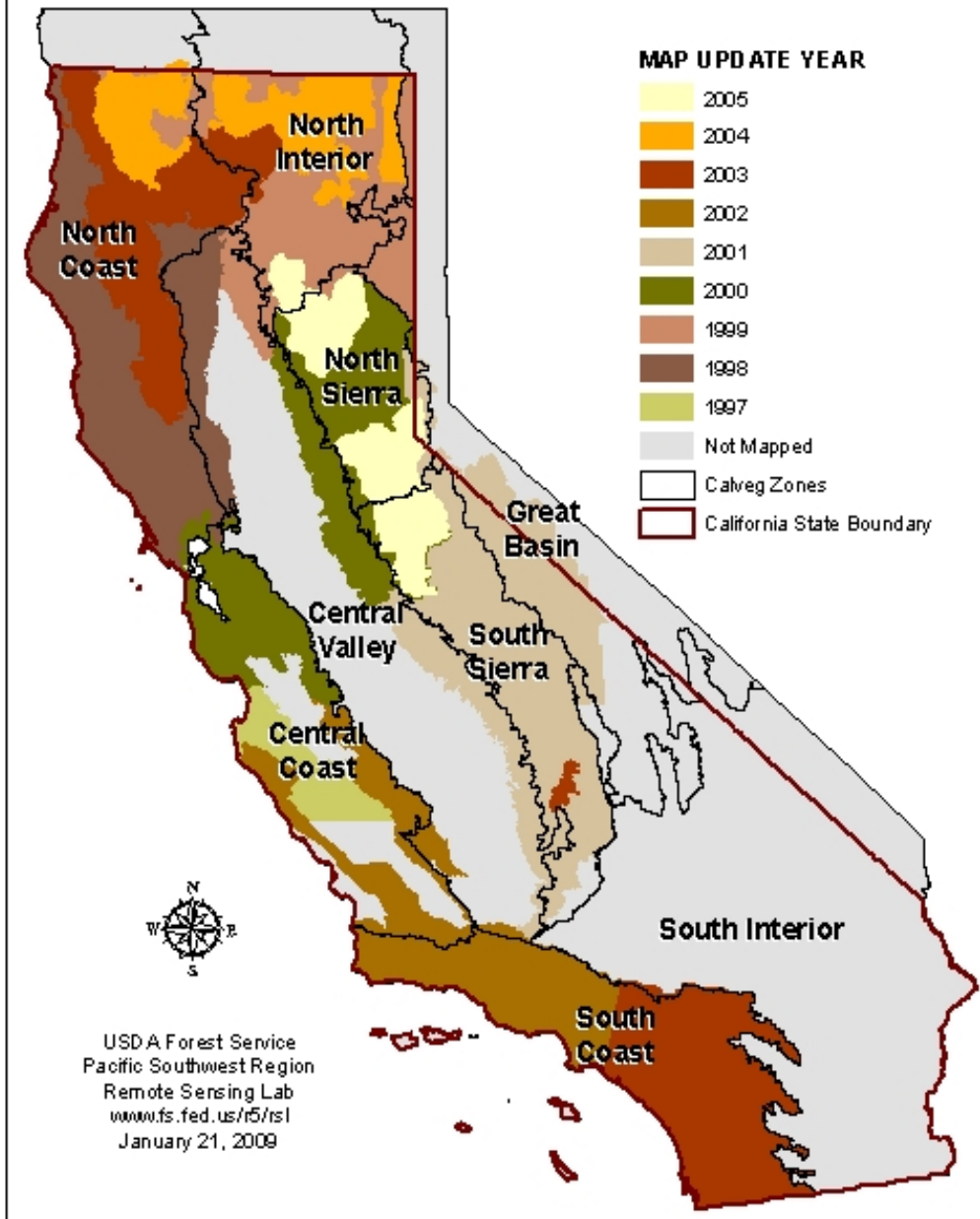


USDA Forest Service - Pacific Southwest Research Station - Forest Fire Laboratory, Riverside, CA



## Map Status by CALVEG Ecological Zones

Extent of Mapped Existing Vegetation



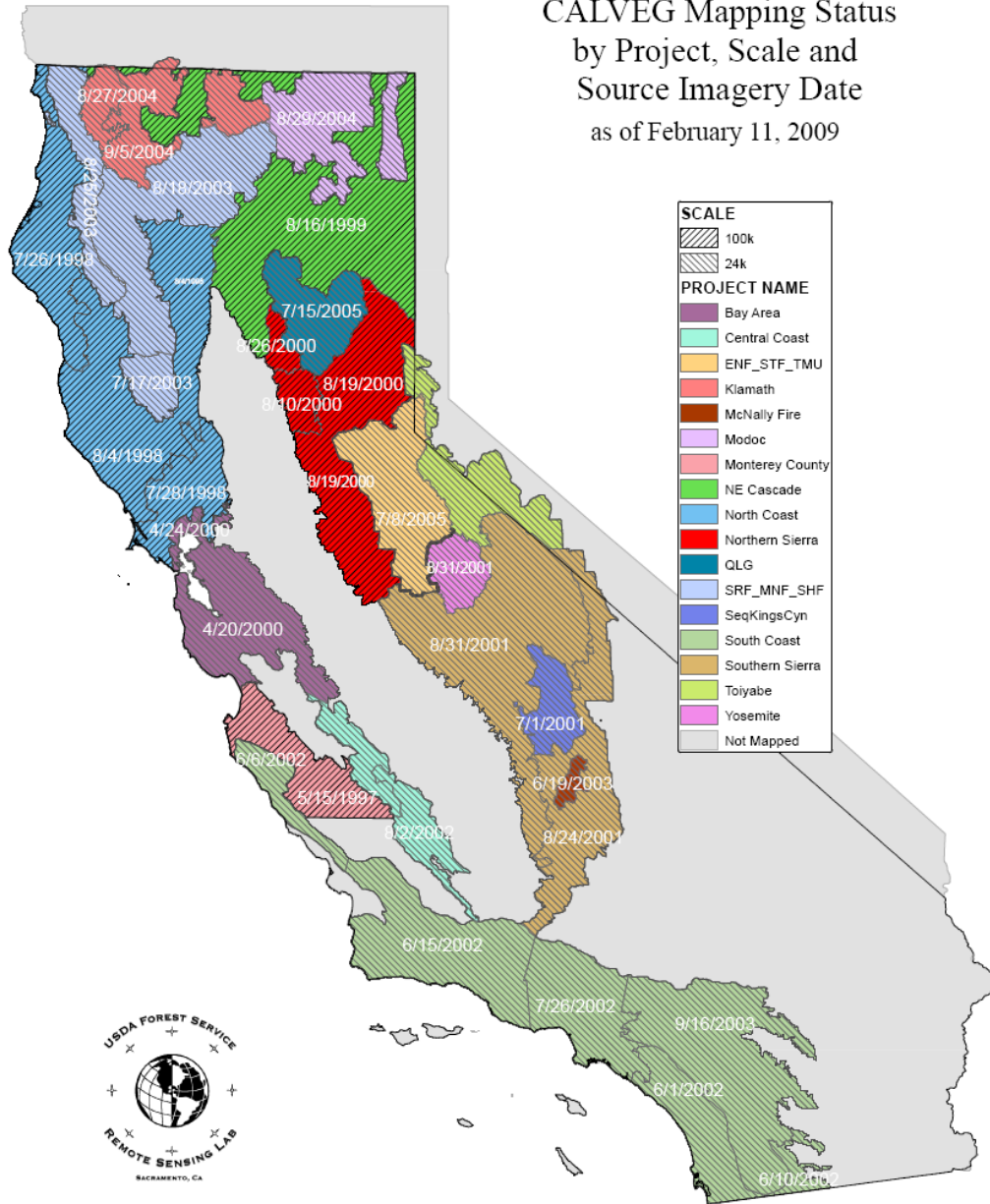
## Current Status

- Private land data from 1997-2002
- NFS land data from 1999-2005
- Some areas not mapped
  - Central Valley
  - Desert
  - Counties of San Luis Obispo and San Benito





CALVEG Mapping Status  
by Project, Scale and  
Source Imagery Date  
as of February 11, 2009



# Current Efforts

- Integrate Existing Vegetation Map Products from Other Sources
- Leverage existing data and programs (FIA, RSL, FHP, FRAP, NLCD)
- Link Vegetation maps to Inventory and derive canopy fuel attributes (Forest Vegetation only)



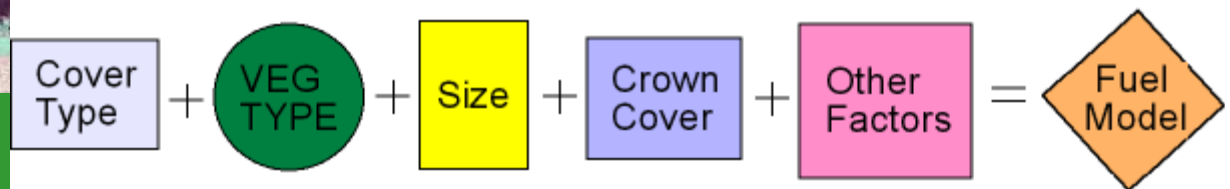
# Fuels Product Description

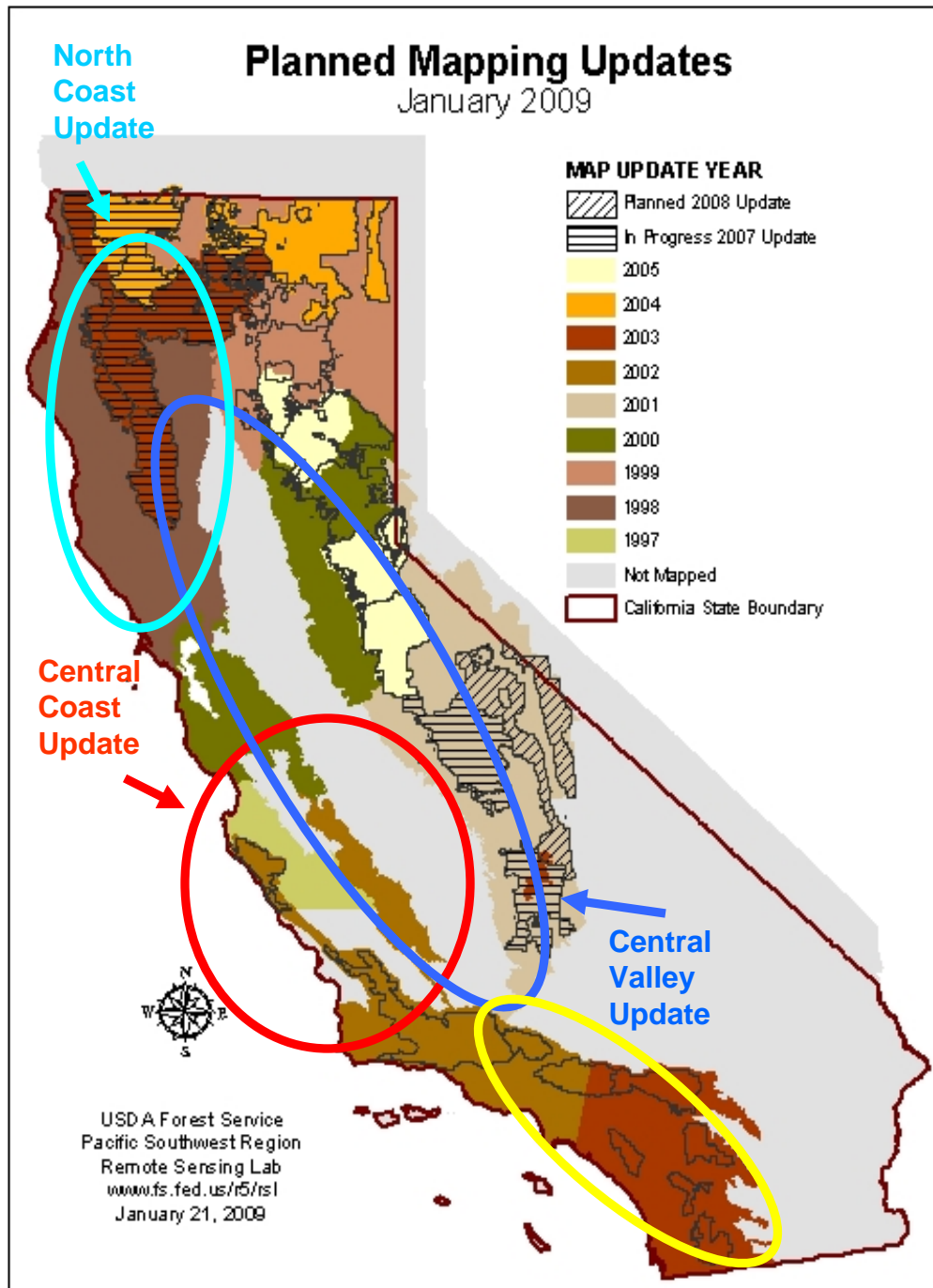


- Surface Fuels (40 categories)
- Ladder Fuels
- Crown Fuels (CBD From FIA)

Inputs

Outputs





# Map Updates In Progress

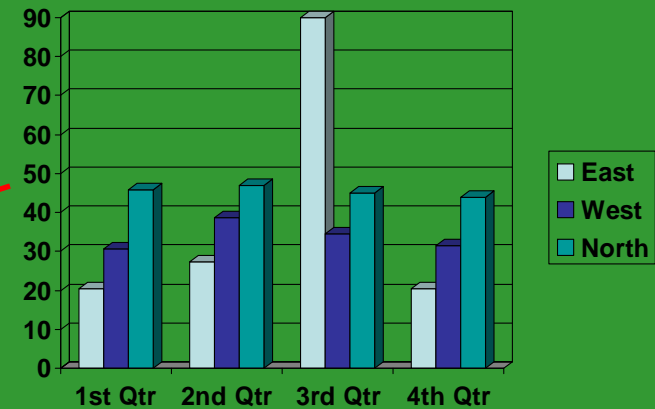
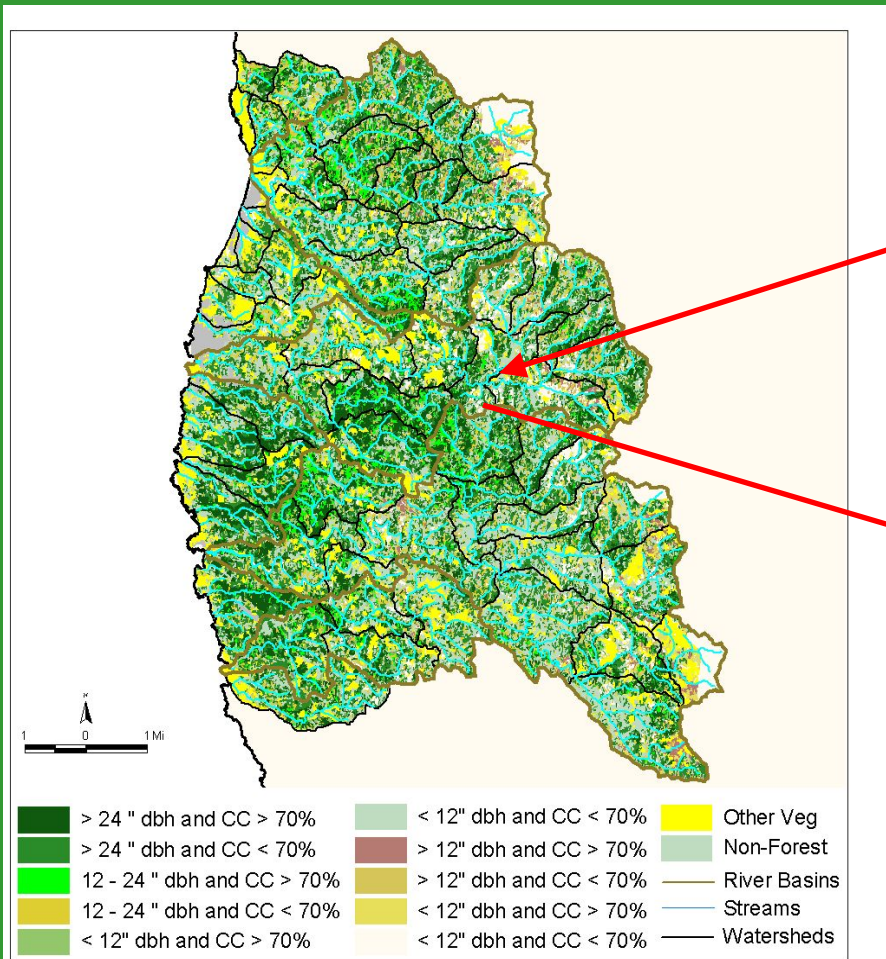
**Integrates Existing data from  
Multiple sources**

- **North Coast – 2007**
  - NWFP products
- **Central Coast – 2001**
  - NLCD products
  - Tree Size mapping (2001 Imagery)
- **South Coast**
  - Change Detection 2009
- **Central Valley – 2001**
  - NLCD products
  - Tree size mapping

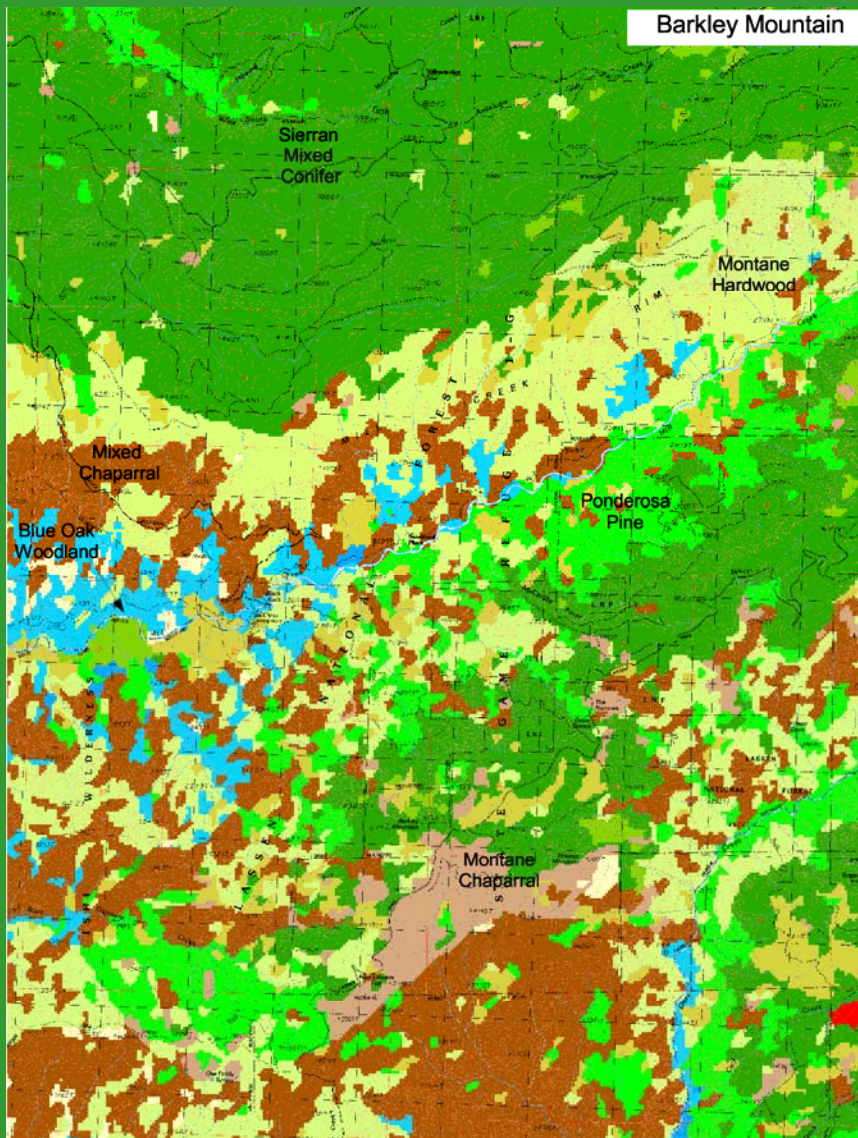




# Quantify the Distribution of Conifer and Hardwood by size and cover



# Vegetation Mapping and Monitoring



## Carbon & Biomass Inventory

- Develop Forest Biomass and Carbon Stock Estimates Using Vegetation maps and Inventories from FIA
- Track Changes with Inventory, Remote Sensing and/or GIS based Activity information (fire perimeters, Harvest, Development, Growth)
- Overlay Activity data on Carbon Surface to Estimate Carbon Stock Changes Annually by sub-category
- Observe changes in Land Cover composition and distribution and adjust strategies as needed



# Applications Using Mapping and Monitoring Data



Assessing Wildlife Habitat  
Monitoring Forest Management  
Hazardous Fire Fuels Mapping  
Post-Fire Vegetation Characteristics  
Trends in Forest Mortality  
Quantifying Watershed Characteristics  
Climate Change Monitoring???



# For More Information

## FRAP Website:

- [http://www.frap.cdf.ca.gov/projects/land\\_cover/index.html](http://www.frap.cdf.ca.gov/projects/land_cover/index.html)
- <http://www.frap.cdf.ca.gov/assessment2010.html>

## USFS RSL Website

- [http://www.fs.fed.us/r5/rsl/projects/frdb/layers/ev\\_mid.html](http://www.fs.fed.us/r5/rsl/projects/frdb/layers/ev_mid.html)
- <http://www.fs.fed.us/r5/rsl/clearinghouse/gettiles.shtml>
- <http://www.fs.fed.us/r5/rsl/projects/classification/>

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